FOXCOM

A Division of OnePath Networks

SAT LIGHT™

7225 Interfacility Link
Installation and User's Guide

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A DIVISION OF ONEPATH NETWORKS

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7225 Interfacility Link
Installation and User's Guide

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1. Front Chapter

1.1. Warranty and Repair Policy

OnePath Networks performs testing and inspection to verify the quality and reliability of our products. OnePath Networks uses every reasonable precaution to ensure that each unit meets specifications before shipment. Customers are asked to advise their incoming inspection, assembly, and test personnel as to the precautions required in handling and testing our products. Many of these precautions are to be found in this manual.

Nullification of Warranty

The Warranty is null and void if the product casing is opened.

The products are covered by the following warranties:

A) General Warranty

OnePath Networks warrants to the original purchaser all standard products sold by OnePath Networks to be free of defects in material and workmanship for one (1) year from date of shipment from OnePath Networks. During the warranty period, OnePath Networks will repair or replace any product that OnePath Networks proves to be defective. This warranty does not apply to any product which has been subject to alteration, abuse, improper installation or application, accident, electrical or environmental over-stress, negligence in use, storage, transportation or handling.

B) Specific Product Warranty Instructions

All OnePath Networks products are warranted against defects in workmanship, materials and construction, and to no further extent. Any claim for repair or replacement of units found to be defective on incoming inspection by a customer must be made within 30 days of receipt of shipment, or within 30 days of discovery of a defect within the warranty period.

This warranty is the only warranty made by OnePath Networks and is in lieu of all other warranties, expressed or implied. OnePath Networks sales agents or representatives are not authorized to make commitments on warranty returns.

C) Returns

In the event that it is necessary to return any product against above warranty, the following procedure shall be followed:

a. Return authorization is to be received from OnePath Networks prior to returning any unit. Advise OnePath Networks of the model, serial number, and discrepancy. The unit may then be forwarded to OnePath

Networks, transportation prepaid. Devices returned collect or without authorization may not be accepted.

b. Prior to repair, OnePath Networks will advise the customer of our test results and any charges for repairing customer-caused problems or out-of-warranty conditions etc.

c. Repaired products are warranted for the balance of the original warranty period, or at least 90 days from date of shipment.

D) Limitations of Liabilities

OnePath Networks's liability on any claim, of any kind, including negligence for any loss or damage arising from, connected with, or resulting from the purchase order, contract, quotation, or from the performance or breach thereof, or from the design, manufacture, sale, delivery, installation, inspection, operation or use of any equipment covered by or furnished under this contact, shall in no case exceed the purchase price of the device which gives rise to the claim.

EXCEPT AS EXPRESSLY PROVIDED HEREIN, ONEPATH NETWORKS MAKES NO WARRANTY, EXPRESSED OR IMPLIED, WITH RESPECT TO ANY GOODS, PARTS AND SERVICES PROVIDED IN CONNECTION WITH THIS AGREEMENT INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. ONEPATH NETWORKS SHALL NOT BE LIABLE FOR ANY OTHER DAMAGE INCLUDING, BUT NOT LIMITED TO, INDIRECT, SPECIAL OR CONSEQUENTIAL DAMAGES ARISING OUT OF OR IN CONNECTION WITH FURNISHING OF GOODS, PARTS AND SERVICE HEREUNDER, OR THE PERFORMANCE, USE OF, OR INABILITY TO USE THE GOODS, PARTS AND SERVICE.

1.2. Reporting Defects

The units were inspected before shipment and found to be free of mechanical and electrical defects.
Examine the units for any damage which may have been caused in transit. If damage is discovered, file a claim with the freight carrier immediately. Notify OnePath Networks as soon as possible.
Refer to Warranty and Repair Policy for further details.

Note

Keep all packing material until you have completed the inspection.

1.3. Certification

The 7225 IFL has CE, FCC, FDA, and UL certification.

1.4. Conventions

In this manual the following special formats are used:

Note

Notes contain information detailing the current topic.

CAUTION

Cautions contain information regarding situations or materials which could damage your product.

WARNING

WARNINGS CONTAIN INFORMATION REGARDING DANGEROUS FUNCTIONS.

1.5. Precautions

WARNING

OPTICAL RADIATION

APPLYING POWER TO THE TRANSMITTER UNIT WILL CREATE A LASER ENERGY SOURCE OPERATING IN CLASS I AS DEFINED BY IEC 825-1. USE EITHER AN INFRARED VIEWER, OPTICAL POWER METER OR FLUORESCENT SCREEN FOR OPTICAL OUTPUT VERIFICATION.

AC POWER HAZARD

THE RACKMOUNT POWER SUPPLY LINE IS EMI FILTERED AND FUSED. THE CHASSIS IS CONNECTED TO EARTH GROUND IN COMPLIANCE WITH SAFETY REQUIREMENTS. ALWAYS USE THE 3 PRONG AC PLUG WITH EARTH GROUND TO AVOID POSSIBILITY OF ELECTRICAL SHOCK HAZARD TO PERSONNEL.

1.5.1. Equipment Safety

To avoid damaging your product, please observe the following:

1. Fuses: To avoid possibility of fire hazard, always replace fuses with the same type and rating of fuse as recommended on the power supply rear label.
2. The input of the transmitter has an optional built-in bias for inserting DC power up the coax to the LNB. Make certain any equipment or test equipment connected to the transmitter input can withstand this bias.
3. The output of the receiver is AC coupled and can withstand the bias from a satellite receiver. ***Do not exceed 25V DC bias.***
4. Do not allow any dirt or foreign material to get into the optical connector bulkheads. This may cause damage to the polished optical connector end faces.
5. The optical fiber jumper cable bend radius is 3 cm. Smaller radii can cause excessive optical loss and/or fiber breakage.
6. If multiple transmitters are installed in the chassis allow sufficient room for adequate ventilation; otherwise the units may overheat causing possible safety hazard or equipment damage.
7. When several units are installed on one 7000M chassis, ensure that the total units' current (including any LNB bias) does not exceed 2A per power supply (e.g. if there are two power supplies the current should not exceed 4A.)

2. Introduction to the Series 7225

The Sat-Light™ 7225 IFL transmits an L-Band RF signal over singlemode fiber from a satellite antenna LNB to control room equipment up to 65 kilometers away. The 7225 IFL is a DFB high dynamic range link for applications that require either a higher quality link or transmission over long distances. The 7225 IFL consists of an optical transmitter (7225T) which receives the L-Band signal from the LNB and an optical receiver (7225R) which connects to a satellite receiver.

The 7225T and 7225R modules plug into a 7000M 3U chassis/power supply which enables expansion of the system to accommodate any 6 Sat-Light modules. Accessories include the Model 7000S Standby Power Supply, the Model 2000 1:1 Redundant Switch, the Model 2100 Amplifier, the Model 2200 Splitter, and the Model 7050 Serial Optical Multiplexer, an asynchronous data link.

The 7225 IFL transmits all satellite modulation schemes - digital or analog. Any FM modulated RF signal is transmitted faithfully. The RF signal is directly modulated and adds virtually no phase noise to the original signal. The direct modulation, coupled with the 7225 Links RF circuitry, guarantees superior signal quality. Featuring a Multi-Quantum Well (MQW) laser diode, the 7225 IFL operates over a wide temperature range, without needing to be cooled. Slow start optical power control protects the laser from DC transients upon turn-on.

Gain Control provides for optimization of the RF signal. LEDs, and back panel monitors and alarms allow for complete system status monitoring and for interfacing with M & C systems. Features

2.1. Options

The 7225 IFL comes with a variety of options:

1. 1550 nm laser - a 1310 nm laser is standard.
2. LNB powering - The transmitter unit can provide 15 VDC for optional LNB powering.
3. 50 Ω Input/Output Impedance/BNC RF connector. Standard impedance is 75 Ω/F type, female connectors are standard.
4. Standalone unit - The 7225 IFL can be installed as a standalone unit. If the 7225 is used as a standalone, a separate power supply must be used.

On the side of the 7225T and the 7225R units is a sticker which lists options 1 to 3. Under each option is a square[1]. If the unit includes a particular option the square under the option should be marked. For example in Figure 1 the LNB option is marked.

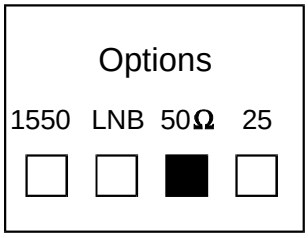


Figure 1 - Option Sticker

[1] There are options on the sticker which are not relevant to the 7225 IFL.

2.2. Product Drawings

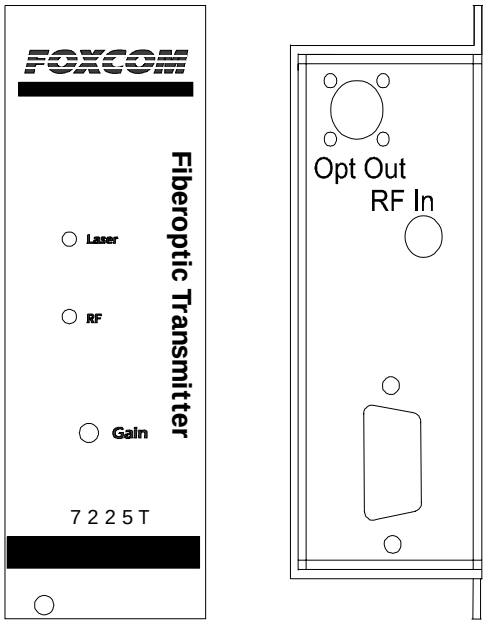


Figure 2 - 7225 IFL Transmitter Front and Rear Panel

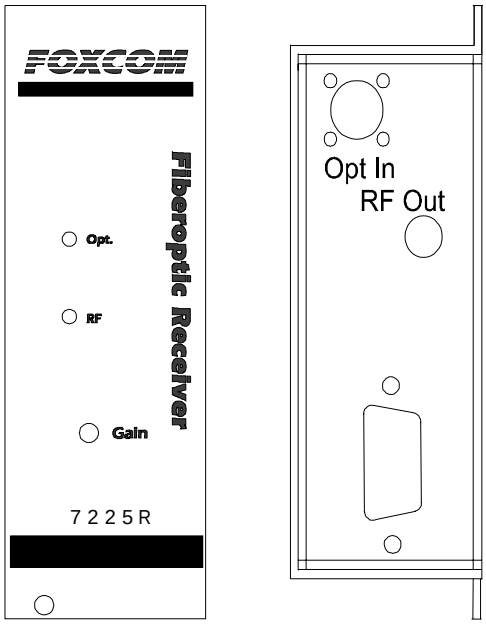


Figure 3 - 7225 IFL Receiver Front and Rear Panel

2.3. Block Diagrams

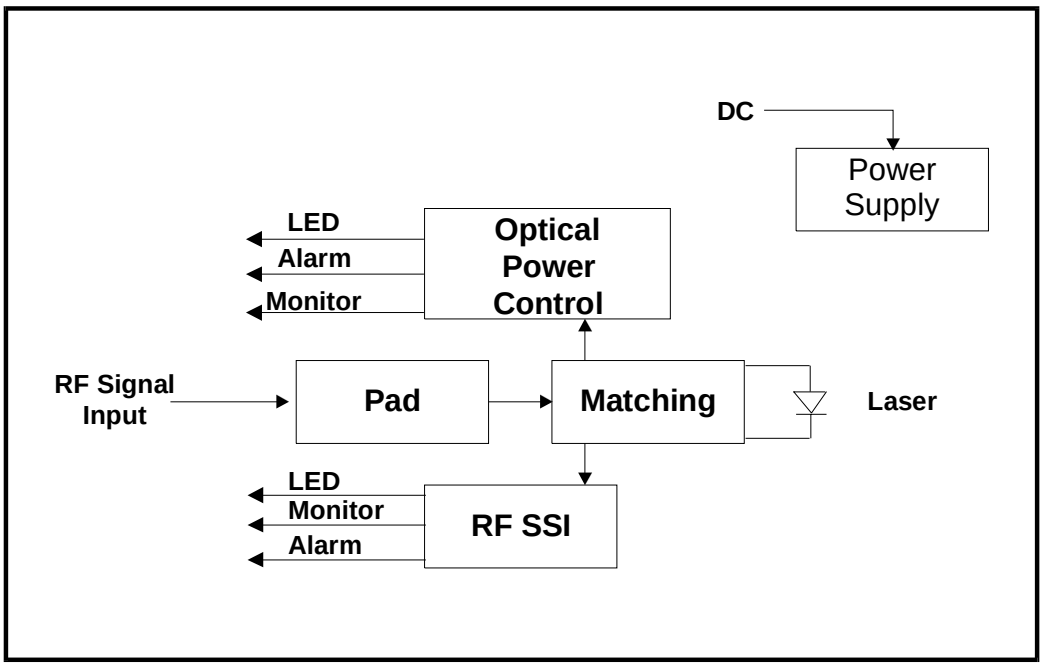


Figure 4 - Transmitter Block Diagram

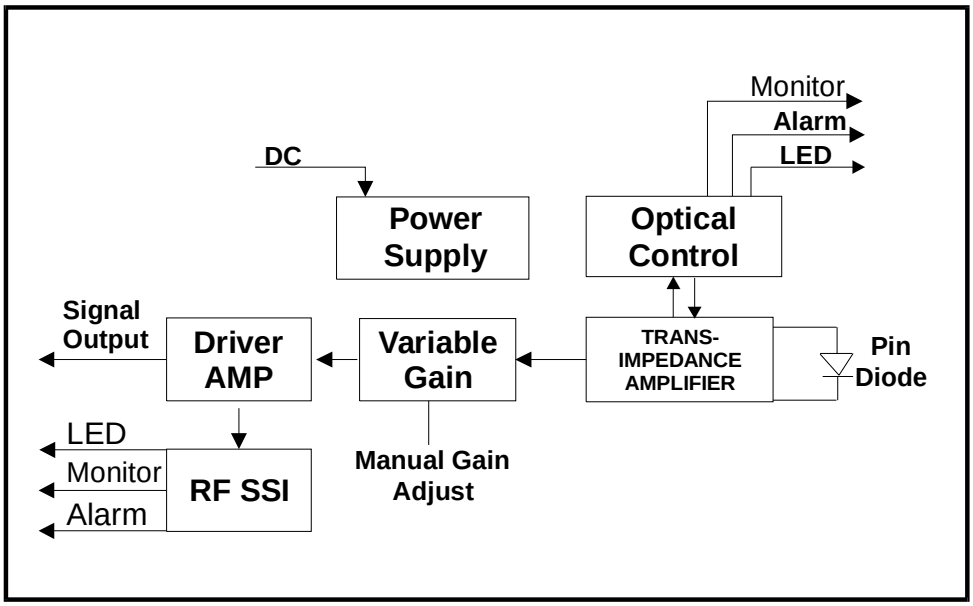


Figure 5 - Receiver Block Diagram

3. Installation

The following section details how to install the 7225 IFL units.

3.1. Setting Up

Setting up the 7225 IFL Transmitter/Receiver consists of the following steps:

1. Setting up the transmitter.
2. Connecting the fiberoptic cable.
3. Setting up the receiver.
4. Monitoring the input/output signals.
5. Powering the IFL.

Refer to Powering the IFL on page 18 for more details regarding power requirements.

Observe all warnings and cautions mentioned at the beginning of this manual (page 7). If after set-up you experience problems, refer to Trouble Shooting on page 27.

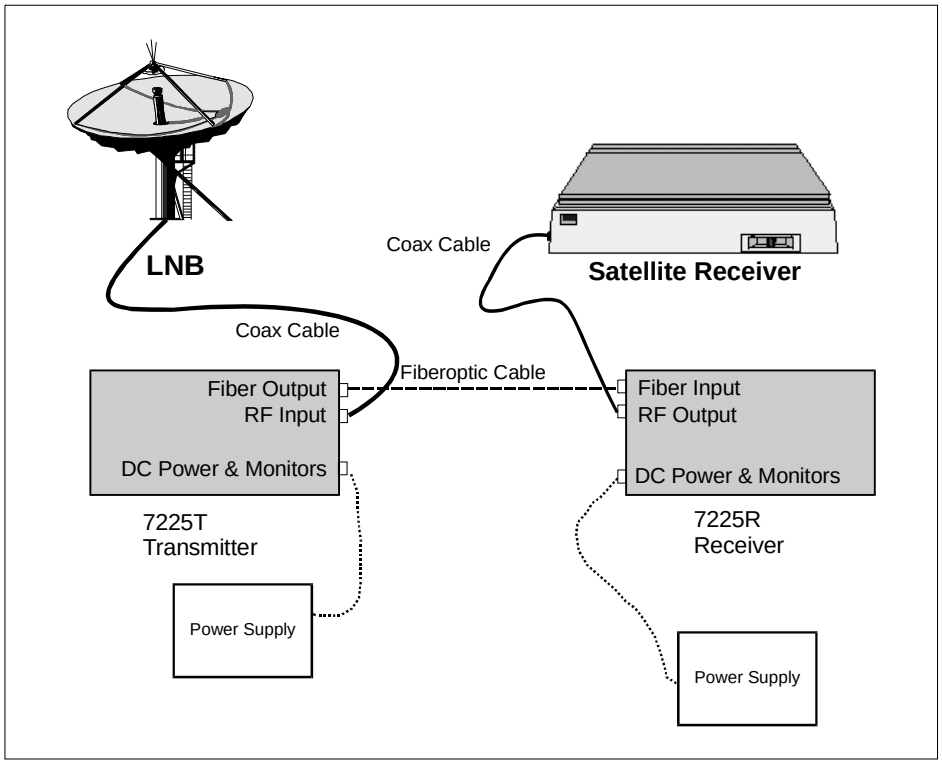


Figure 6 - Typical Application of a 7225 IFL

3.1.1. Setting up the Transmitter

1. Place the 7225T in the 7000M Chassis. The operating base plate temperature must be between -10° C to 55° C.
2. Apply AC power to the chassis. The Power Supply's LED should be lit.
3. Mount the 7225T into the chassis. The Laser LED should be lit.
4. Using an optical power meter, measure the optical power. Insert the meter's cable into the Transmitter's optical connector. Power levels should be between 2 - 5 mW.

   Alternatively, use a DVM to measure the voltage at pin #1 of the 6 pin connector (rackmount) or pin #6 of the 9 pin connector (standalone). The power level should be -4.5 ± 0.3 VDC.
5. On the rear panel, connect the coax cable to the RF Input Connector.
6. On the rear panel, connect the fiberoptic cable to the Optical Connector.
7. Adjust the Gain Control Potentiometer to give the desired output power. Using a small screw driver, turn the potentiometer (located on the front panel) to increase or decrease the gain.
   - To ***increase*** the gain, turn the gain control clockwise.
   - To ***decrease*** the gain, turn the gain control counterclockwise.
   - For more information refer to Transmitter Gain Control on page 25.

Note

If either LED is not lit, refer to Trouble Shooting on page 27.

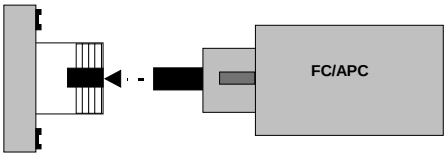
3.1.2. Connecting the Fiberoptic Cable

Before connecting the cable:

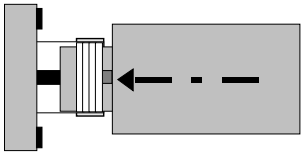
1. Wipe the connector with a lint-free cotton cloth.
2. Note the polarity key of the optical connector before inserting.

To connect the cable:

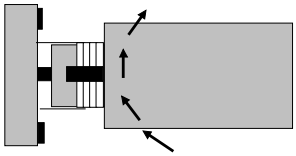
1. Line Up the Polarity Key.



2. Insert the connector.



3. Tighten the connector.



3.1.3. Setting Up the Receiver

1. Place the 7225 Receiver in the 7000M Chassis. The operating base plate temperature must be between -10° C to 55° C.
2. Apply AC power to the chassis. The Power Supply's LED should be lit.
3. Mount the 7225R into the chassis.
4. On the rear panel connect the fiberoptic cable to the Optical Connector. The Opt. LED should be lit.
5. Using an optical power meter, measure the optical power coming to the Receiver from the fiberoptic cable. The power levels of the Receiver should be the power level measured at the Transmitter minus the fiber loss[2].

   Alternatively, use a DVM to measure the voltage at pin #6 of the D type connector. The power level should be 1V to each 1 mW measured at the Receiver input.
6. On the rear panel, connect the fiberoptic cable to the Optical Connector. The Opt. LED should be on.
7. On the rear panel, connect the coax cable to the RF Output Connector.
8. Adjust the Gain Control Potentiometer to give the desired output power. Using a small screw driver, turn the potentiometer (located on the front panel) to increase or decrease the gain.
   - To ***increase*** the gain, turn the gain control clockwise.
   - To ***decrease*** the gain, turn the gain control counterclockwise.
   - For more information refer to Receiver Gain Control on page 26.

Note

If either LED is not lit, refer to Trouble Shooting on page 27.

[2] [2] Fiber loss is defined as:
(attenuation/km x length (km) of the fiberoptic cable) + (1.0 dB x number of connectors).
For example if a signal with an optical wavelength of 1310 nm is transmitted over a link 10 kilometers long which had two connectors the loss would be:
(0.4 dB/km x 10 km) + (0.5 dB x 2) = 5.0 dB

Alternatively if a signal with an optical wavelength of 1550 nm is transmitted over a link 10 kilometers long which had two connectors the loss would be:
(0.27 dB/km x 10 km) + (0.5 dB x 2) = 2.7 dB

3.1.4. Measuring the RF Signal Strength

The Receiver's RF signal strength can be monitored during operation via a DC RF signal-strength monitor. Maintenance personnel can perform a simple verification process.

To measure the RF signal strength:

1. Using a Digital Volt Meter, measure the voltage at the connector pin #4 (both Rackmount and Standalone).
2. Refer to Receiver Gain Control on page 26 for further details regarding voltage levels.

3.1.5. Powering the IFL

- Transmitter power requirement: 15VDC @ 270mA (excluding LNB Drive option).
- Receiver power requirement: 15VDC @ 360mA.
- The Standalone Transmitter/Receiver is powered by a user-supplied external DC power supply.
- The Rackmount Transmitters/Receivers are plugged into the rackmount chassis. The chassis can accept and power up to six units.

Note

At temperatures below -10°C, the Transmitter's internal heater will require an additional 120 mA. The Transmitter's total power requirement will then be 390 mA.

CAUTION

Ensure that there is a good airflow around the chassis rackmount.

7000M Chassis

The 7000M Chassis provides power to the plug in units. The power supply is a linear unregulated type. Each plug-in regulates its own voltage. The 7000M provides:

- 15 to 18 VDC (unregulated) @ 2.2 amps power
- AC input @ 110/220 VAC (user selected)
- Units can be plugged in "hot standby"
- An internal 5 amp fuse

7000S (optional) Hot standby power supply

For applications demanding the utmost in reliability and uptime, the 7000S standby power supply can be optionally plugged in to the standard chassis. The 7000S features hot swapping - supplies may be installed and removed even during operation. Each power supply is fully redundant and can power a completely loaded chassis on its own should its "partner" fail. During normal operation the two units share the load by means of current steering diodes located on the rear panel.

3.2. Panel Descriptions

On the Front Panel of the 7225 IFL unit are two LEDs. Both LEDs should be on when the unit is in use. The following tables describe the LEDs.

Table 1 - 7225 Transmitter LEDs

LED Name	LED Function
Laser	Indicates if the optical output power control is functioning
RF	Indicates if the RF signal is above the minimal level

Table 2 - 7225 Receiver LEDs

LED Name	LED Function
Opt.	Indicates if the optical reception power is within limits
RF	Indicates if the RF signal is above the minimal level

4. Product Specifications

The following section details the:

- 7225 IFL specifications
- Model dimensions
- Pinouts
- Alarms
- Monitors

4.1. 7225 IFL Specifications

Table 3 - 7225 IFL RF Specifications

RF Characteristics	
Frequency Range (MHz)	950 - 2150
RF Total Input Power (dBm)	-40 to -20
RF Total Output Power (dBm)	-45 to -15
Tx/Rx Gain Adjustability (dB) - Manual	± 10 dB
Return Loss (dB)	13 (min.)
Input Power (no damage) (dBm)	+ 10 (max.)
CNR (dB)(@ 36 MHz	35
Intermodulation Products (dBc)	-40 (max.)
Flatness (dB)	± 1.5 (typical); 2.0 dB (max.) ± 0.25 (max.) @ 36 MHz
Optical Specifications	
Wavelength	1310 ± 10 nm (1550 nm optional)
Optical Power Output	2 to 5 mW
Fiber Loss	0.4 dB/km @ 1310 nm 0.27 dB/km @ 1550 nm
Optical Return Loss	-60 dB
Optical Connector Loss	0.5 dB/mated pair
Optical Budget	16 dB

Miscellaneous	
Power for Standalone **Transmitter** **Receiver**	 +15 VDC @ 270 mA (390 mA @ temp. -10° C) +15 VDC @ 360 mA
Power for Rackmount (max.)	110 or 220 VAC 50/60Hz 60 Watts
Chassis Size	19” x 3U x 7”
Chassis Capacity	6 plug-ins, and 2 power supplies
Unit Size	4” x 4.8” x 1.3”
Optical Connector	FC/APC
Operating Temperature Range	-10° C to +55° C
Storage Temperature Range	-40° C to +85° C

All specs are subject to change without prior notice.

Note

Optical fiber plant must be singlemode 9/125 and low reflection. Use FC/APC connectors only.

4.2. Model Dimensions

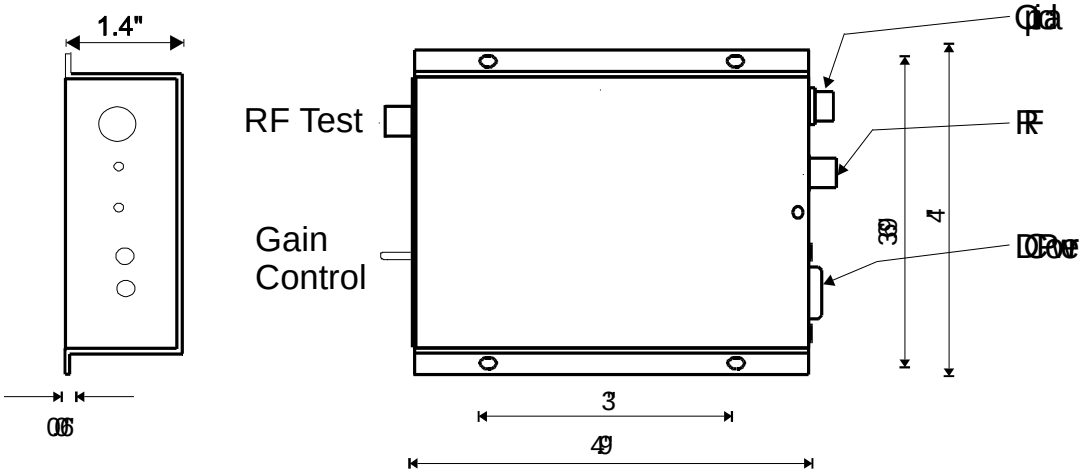


Figure 7 - Unit Dimensions

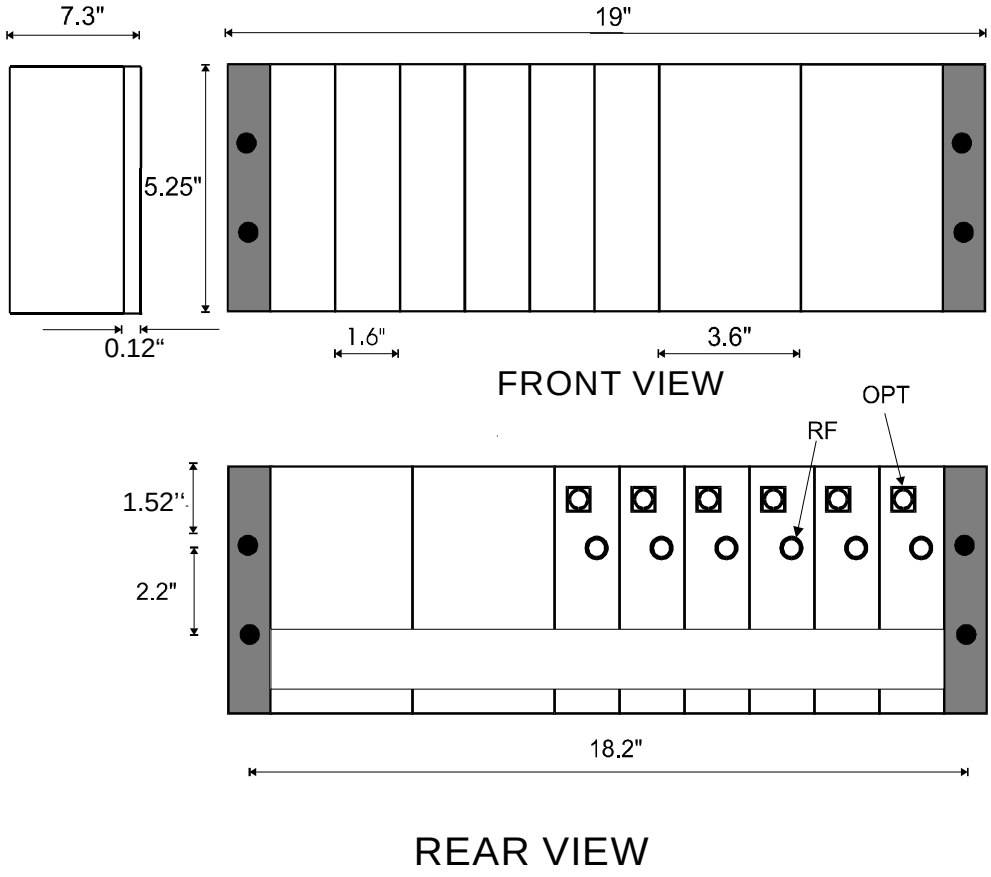


Figure 8 - Chassis Dimensions

4.3. Alarms and Monitors Pinouts

The unit's pins are found at the backplane of the 7000M chassis. The 7000M backplane incorporates 6 slots, each of which has its own 6 pin blank header associated with it. Any monitor voltages to be measured may be done between the chassis ground and the required pin. The pins are numbered as follows:

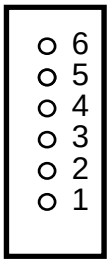


Table 4 - 7225T Transmitter Pinout

Standalone 9 Pin Connector	Rackmount 6 Pin Back Panel Connector	Function	Description
1		+15V Power	270 mA (excluding LNB Drive)
2		Not Used	
3		Power Ground	DC Return
4	4	RF Signal Strength Monitor	RF Signal Strength Indicator; Range 2.5 ± 0.5 VDC[3]
5	6	PDI	Measures Laser Optical Power; Range -2 to -4.5V
6	1	LSRI	Measures Laser Bias; Range -4.5 ± 0.3V
7	2	RF Alarm	Sinks Current at RF High/Low TTL
8	3	LSR Alarm	Sinks Current at loop unlock High/Low TTL
9	5	LNB Bias (optional)	External LNB Bias

Dependent on Order

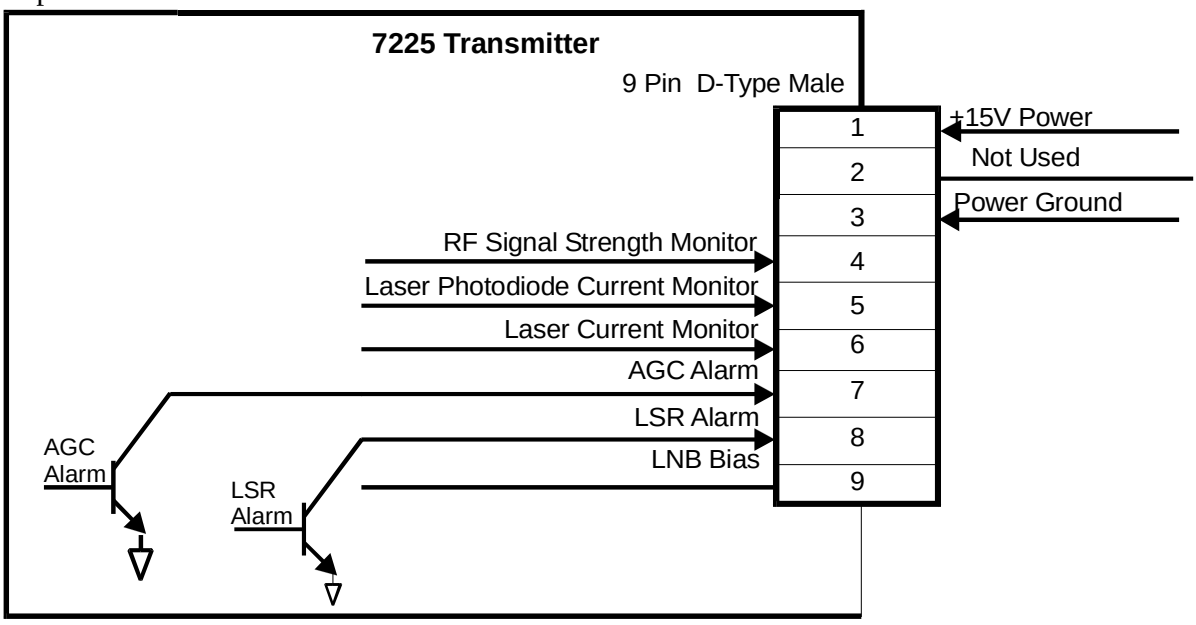


Figure 9 7225 Transmitter Pinout

[3] with –40 dBm input

Table 5 - 7225R Receiver Pinout

Standalone 9 Pin Connector	Rackmount 6 Pin Back Panel Connector	Function	Description
1		+15V Power	15VDC @ 360mA
2		Not Used	
3		Power Ground	DC Return
4	4	RF Signal Strength Monitor	RF Signal Strength Indicator; Range > 1 VDC
5	6	Optical Power Input Level Monitor	1V/mW Optical Power Received
6	1	Spare	Not Used
7	2	RF Alarm	Sinks Current at RF High/Low Open Collector
8	3	Optical Power Alarm	Sinks Current at Low Optical High/Low Open Collector
9	5	Spare	Not Used

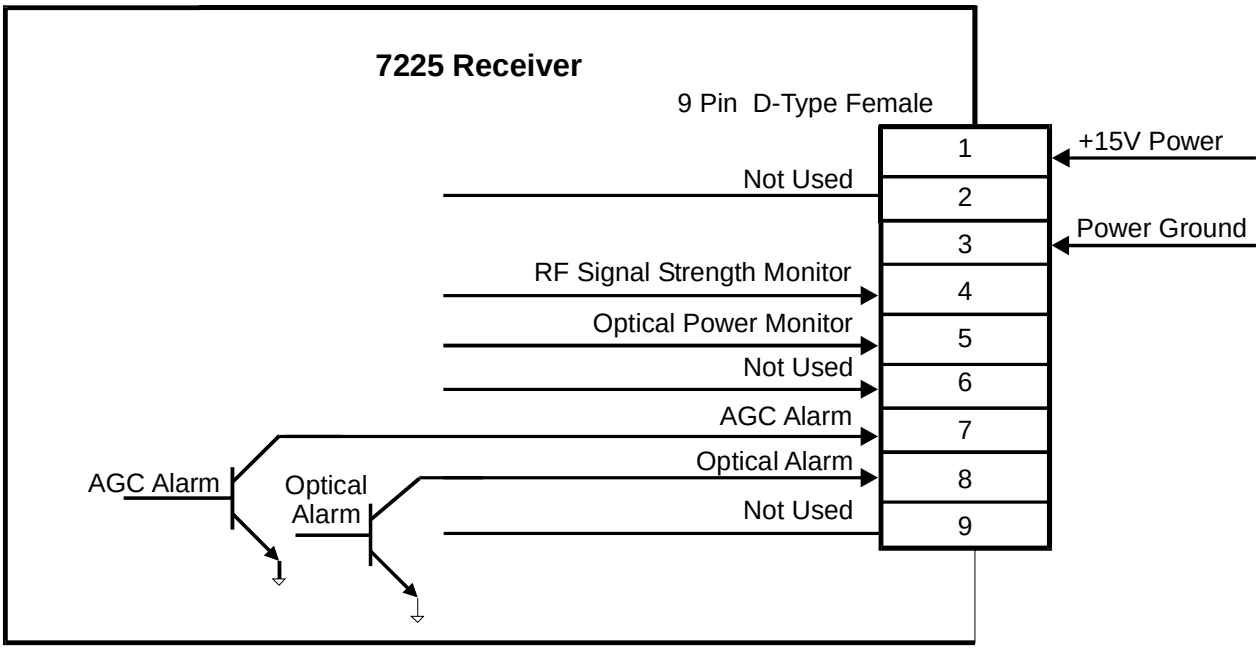


Figure 10 7225 Receiver Pinout

5. Gain Control

The 7225 IFL unit requires no maintenance, but the user can adjust the transmitter and receiver gain by 20 dB. The gain can be between 0 to -20 dB.

All internal adjustments have been set up at the factory; the only user adjustments are input and output RF signal levels accessible from the front panel and described in the following sections.

5.1. Transmitter Gain Control

Since Gain Control sets a constant input gain to the laser, an initial setup is required to ensure the input signal level is not too high (overdriving the laser) or too low (noisy). These variations can be caused by changes in dish pointing, rain fade or satellite channel loading, or any other reason.

Since MGC sets a constant input gain to the laser, an initial setup is required to ensure the input signal level is not too high (overdriving the laser) or too low (noisy). These variations can be caused by changes in dish pointing, rain fade or satellite channel loading, or any other reason.

The signal level must be between 2 to 5VDC.

To set the Transmitter MGC:

1. Adjust the Gain potentiometer while monitoring the RF signal voltage. The 7225 IFL is designed to provide optimal output[4] at 4.0V ± 0.5V. Therefore regardless of the input the Manual Gain Control should be set to provide this output.
2. If there is input signal level variation expected, it is best to leave some "headroom" should the signal level become too strong and result in distortion. It is usually better to adjust the signal lower rather than higher.

[4] Optical output refers to optimal CNR and IMD.

5.2. Receiver Gain Control

Receiver Gain Control allows the user to set the output signal levels. The Gain potentiometer is adjusted while monitoring the voltage of the Receiver "RF Sig." Monitor (Pin #4 on the 6 Pin Connector). The chart below provides approximate settings for desired output levels.

Table 6 - Receiver RF Signal Voltage5

RF Output Level (dBm) [6]	**RF Signal Voltage Setting**
-15	10V ± 1
-20	6V ± 0.5
-30	1V ± 0.2
-40	0.1V ± 0.02

Note

The potentiometer is a 10 turn potentiometer.

[5] @ 50 kilometers @16 MHz

[6] Total Output Power

6. Trouble Shooting

The 7225 IFL was tested before it left the factory. However if you are experiencing difficulties consult the list below for possible solutions. If your system is still experiencing problems, please attempt to isolate and identify the malfunctioning unit.

Table 8 - Trouble Shooting

PROBLEM	POSSIBLE CAUSE
1. Laser LED not on	1. No DC power to the unit. Possible power supply problem or AC power input problem. Check the fuse. 2. Verify LSRI monitor is between -4.8 and -4.5V. If not, laser may have overheated. Disconnect power or remove plug in and allow to cool. Try again with better airflow. 3. If an optical power meter is available, measure the optical power out of the transmitter. The power should be 0.3 mW to 0.6 mW. If an optical power meter is not available, then use another receiver to determine if there is optical power emerging from the transmitter (use the 5 meter jumper cable). If there is no optical power, then the transmitter unit is malfunctioning. If any or all the above are not within the guidelines, the transmitter unit is faulty.
2. Lack of RF signal present at Receiver, yet optical power is functioning.	1. If the unit has an LNB drive option, verify that the correct LNB bias is coming down the center of the RF connector at the transmit site. 2. Verify that the dish is pointed and correctly receiving satellite signals. Conclusion: If signal still not present then Transmitter input stage amplifier is defective. Contact OnePath Networks.
3. No optical power, LED not illuminated.	1. There is a break or severe bend in the fiberoptic cable. Use an optical power meter or another functioning receiver unit to verify optical power coming down the fiber. 2. Optical power too low, too many splits, too long a distance (thus exceeding optical budget). System *may still function* without LED illuminated although at reduced performance. 3. The transmitter is not functioning, see above.
4. Optical power light illuminated with disconnected optical input.	Damaged (leaky) photodiode. Unit may still function, otherwise contact Factory for service.

7. Appendix 1 Cleaning Fiberoptic Connections

The unit has an FC/APC (or other optional) angle polished optical connector for very high optical return loss performance. The units are specified into singlemode fiber i.e. 9/125 micron core diameter. Full performance is specified only for low return loss optical plant - meaning that the fiber must be fusion spliced and all connections or splices must have a return loss greater than -60 dB. With these guidelines in mind, link lengths beyond 20 kilometers (DFB based products) can be achieved with high performance. Specific performance and/or design assistance is available by request from OnePath Networks.

If there is low/no signal or noisy signal at a OnePath Networks module, the connector should be cleaned. Dirt on the inside connector tip can impair the flow of light causing problems in signal transmission. OnePath Networks modules are sealed but dirt can occasionally enter during installation and alignment.

8. Appendix II Installing a Standalone Unit

To install the 7225T-STD or 7225R-STD Standalone:

1. Place the 7225 unit on the standalone flange, matching the holes.
2. Using four screws (#4 or #6) secure the unit and the flange to the wall.
3. Apply AC power to the standalone power supply unit.
4. Connect the 7225 unit to the power supply. The Laser LED should be lit.

All remaining steps are the same. Refer to Setting up the Transmitter on page 14, and Setting Up the Receiver on page 16.